

## **Assistance Agreement Quarterly Report: 3<sup>rd</sup> Quarter**

**Date of Report:** September 30, 2000

**Agreement No:** R82806301

**Title:** **Baltimore Supersite: Highly Time and Size Resolved Concentrations of Urban PM<sub>2.5</sub> and its Constituents for Resolution of Sources and Immune Responses**

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**Institution:** Department of Chemistry and Biochemistry, University of Maryland, College Park, MD

**Research Category:** Particulate Matter Supersites Program

**Project Period:** January 15, 2000 to December 31, 2003

**Objectives of Research:** Our primary objectives are to i) provide an extended, ultra high-quality multivariate data set, with unprecedented temporal resolution, designed to take maximum advantage of advanced new factor analysis and state-of-the-art multivariate statistical techniques; ii) provide important information on the potential for health effects of particles from specific sources and generic types of sources, iii) provide large quantities of well characterized urban PM for retrospective chemical, physical, biologic analyses and toxicological testing, iv) provide sorely needed data on the sources and nature of organic aerosol presently unavailable for the region, v) provide support to existing exposure and epidemiologic studies to achieve enhanced evaluation of health outcome-pollutant and -source relationships, and vi) test the specific hypothesis listed in our proposal.

### **Progress Summary/Accomplishments**

We continue to hold weekly PI teleconferences on an as-needed basis. We are planning our second External Science Advisory Committee Teleconference for the first or second week in December, 2000. We have participated in the McMurry teleconferences on aerosol measurements (especially concerned with the issue of relative humidity during sampling) and in the recent Eastern Supersites conference call organized

by Dr. Paul Solomn. Professor Hopke has participating in regularly scheduled teleconferences regarding harmonization of AQ across the Supersites and has begun work on the project QAPP. Professor's Rogge and Ondov have participated (Rogge, regularly) in the teleconferences on organic analysis methods. We have produced a summary position paper on our plans to deal with the RH issues involving the various aerosol samplers and spectrometers, and have discussed at some length, the allocation of resources to sampling in South Baltimore. We have decided to conduct 1 intensive campaign in South Baltimore, starting in May of 2001, for a period up to 1 month, after which, our equipment will be moved to Clifton Park, to permit startup at this site around well in advance of July 1, 2001. We will allocate the remainder of our Summer intensive resources to Lake Clifton during the month of July, 2001, to coincide with the Eastern Supersite and NARSTO sampling campaigns.

**Lidar.** Marc Parlange has taken delivery on his lidar system and verified its operation. A new detector remains to be installed and work will ensue in the coming months to develop some data sets.

**SEAS Improvements.** We have begun making improvements to the University of Maryland Semicontinuous Elemental Analysis system (SEAS). Specifically, we have completed redesign of the SEAS condensor and virtual impactor modules. Condensor air temperature measurements and aerosol throughput test on the former have now been completed. The newly -designed condensor is 5 cm shorter than the previous unit and wall losses have been reduced by a factor of 3. Condenser wall losses for 2 : m particles are now only 10%. We built a disassembleable virtual impactor system to allow testing of various acceleration and collection nozzles. Stokes numbers were measured by calibrating with monodisperse particles. The data were used to optimize the impactor parameters. On the basis of this, we settled on a 3 mm acceleration nozzle, with a Reynolds number of 40,000, and with a minor flow to total-flow ratio of 20%. This necessitates adding additional real impactor units to handle the increased minor flow (which was previously 5% of the total flow). However, the new Stokes Number (for 50% collection).is modeled to be reduced from 1.4 to about 0.5, which will allow for collection of 1 : m droplets with 50% efficiency. In addition, we anticipate that submicrometer droplet collection efficiencies will exceed 40%. These improvements should improve impactor throughput efficiency. Tests are underway on the new system and will be completed by October 1<sup>st</sup>. Additionally, we have reevaluated the steam injection module and are building a single steam injector equipped with temperature control to prevent overheating. A further modification will be to preheat the inlet air. Tests show that 30 C inlet temperatures are readily achieved and should boost supersaturation substantially and substantially improve nucleation and growth of hydrophobic particles. Lastly, we have decided to move instrument control from the CR23X data logger platform to a LavView-driven PC, and have largely completed writing the control programs. Input and output PC boards have been ordered. We have constructed a prototype Trap impactor for application in SEAS. Results are encouraging and, if successful, will permit construction of a more compact design, because the trap impactor will replace both the virtual and real impactors in the current system. We have hired a Chief Analytical Chemist to help test the SEAS and organize and execute chemical and elemental analyses for the Baltimore Supersite.

**Other Equipment.** We have take delivery on our semi-continuous EC/OC and particulate Nitrate monitor. Orders have been placed for the semicontinuous sulfate monitor. We have identified a suitable

system for collection of high-volume aerosol samples for detailed organic compound analysis and are discussing some modifications with the vendor. Dr. Wexler has completed design of our single-particle mass spectrometer and has begun ordering the parts. He plans to complete construction of the instrument in the December/January time frame.

**Laboratory Trailers.** We have prepared detailed specifications for purchase of our two laboratory trailers and are obtaining initial bids.

**Website:** Our Static Web site has been placed on line at: [www.chem.umd.edu/supersite](http://www.chem.umd.edu/supersite)  
Color maps of the Baltimore Region have been prepared in ARCVIEW and loaded onto our website. The maps show major PM emissions sources (obtained from the EPA AIRS data base), metals emission sources (TRI data), and estimates of emissions as well as the location of our sampling sites and key streets.

**South Baltimore Site Selection.** Drs. Ondov, Hopke, and Tuch visited South Baltimore in search of a location for a sampling site in this area. We have tentatively identified the grounds of the FMC installation and a site near a BG&E switch yard has suitable locations and have received verbal permission for access. The sites have been selected after considerable discussion between the various coPIs and our deliberations will be reviewed by our External Science Advisory Committee, tentatively planned for December. In view of the nature and locations of sources, which are abundant on both sides of the Patapsco River, there seems to be no clear advantage to either South Baltimore or Dundalk (on the East side of the Patapsco River). However, asthma and exposure studies planned by JHU will be conducted in the Brooklyn Community near the sites identified on the FMC property in South Baltimore. As support of these studies is a stated goal of the Baltimore Supersite Project proposal, the South Baltimore locations still appear to be the locations of choice. The FMC company makes pesticides, one of which is a synthetic pyrethrin (pyrethrin occurs naturally in chrysanthemum flowers). We are endeavoring to find out more about FMC's products and production processes to assess the possibility that some chemical release might interfere with our organic chemical measurements.

**Coordination with MDE.** Drs. Ondov and Tuch met with several Maryland MDE representatives and Rolf Zeisler from NIST to discuss resource allocations and power requirements at the Clifton Park Supersite. Victor Guide from EPA Region III also attended. Pending written authorization from Region III, MDE has agreed to move their PAMS site to Clifton Park for the duration of the Supersite Project. PAMS measurements include VOC canister collections during the ozone season, as well as semicontinuous chromatographic VOC measurements. MDE agreed to provide the requested FRM, Speciation, and continuous mass monitoring equipment. These systems will be operated on a 1 in 3 day basis (every day during intensive sampling campaigns) by UMCP and MDE personnel. Subsequently, Ted Erdman has provided authorization by email for the purchase of two sets of speciation samplers, analysis of samples, and purchase of a continuous PM<sub>2.5</sub> monitor. We are now engaged in discussions with Region III, MDE, and PA regarding the possibility and desirability of having funds provided to upgrade MDE's and PA's 50°C TEOM samplers to operational capability at 30°C. Washington, DC, uses a CAMMS unit at their McMillan Reservoir site, and has no TEOMs anywhere. Thus, we support MDE's desire to purchase a

CAMMS for deployment at our supersite in Baltimore.

**Permission for Site Use.** Because of the large amount of equipment that we propose to operate at Clifton Park, we contacted the various State and City agencies who we believe might have jurisdiction over the specific plot of land, i.e., the now abandoned N. Rose Road. We've now submitted a written request for "Right of Access" to the City Department of Parks and Recreation.

**Publications/Presentations:**

No publications have yet been prepared, however, we have prepared position summaries of our deliberations on the relative humidity, South Baltimore site selection, and allocation of resources among intensive sampling periods. Presentations made include those to various colleagues and, collaborators. Additionally, the improved SEAS component designs were presented at the Air and Waste Management Association Meeting entitled Measurements of Toxic and Related Air Pollutants, held September 12-14, in Durham, N.C.

Drs. Ondov and Tuch provided an overview of the Baltimore Supersite Project to Professor Udo Lambrecht, who visited our laboratory on Thursday, September 14th.

**Future Activities:**

1. We will continue to hold weekly PI teleconferences as needed.
2. We will deliver a summary position paper on the RH issue to our ESAC and post it on our Web site.
3. We will attend the AAAR meeting in St. Louis, in November and will attend Supersite coordination meetings.
4. We expect that Dr. Patrick Pancras will begin assuming his duties as Chief Analytical Chemist on or about November 1, 2000.
5. We expect to obtain a contract for enlarging the security fence around the Lake Clifton site in October or, possibly, November, i.e., after we have received permission from Parks and Recreation to do so.
6. Additional Instruments to be purchased include: Continuous Sulfate monitor (R&P estimates that these will be ready to ship in January, 2001); Drum impactors (we are working with Dr. Thomas Cahill on this); and our high-volume organic sampler. We expect to write a purchase order for these by the end of October, 2000.
7. The Baltimore Supersite project will initiate its 12-month field study on or about 1 May, 2001.

**Supplemental Keywords:** Single Particle Mass Spectrometry, ROS, Cytokine, Receptor Modeling